Remarks/Arguments

In this paper, applicant corrects the following defects in the amendment previously submitted on January 24, 2005:

1. The number for the canceled claims is changed from 17 – 27 to 12 – 18.
2. The number for the newly inserted claim is 19.
3. This application claims priority of a previously filed application, which is now a U.S. patent. The patent number is provided in the amendments to the specification.
4. The following is the Remarks/Arguments section with the errors corrected.

Applicant thanks Examiner Edmonson for her careful examination of this application and clear explanation of the objections to the drawing figures and claim rejections. In response, applicant submits with this paper a set of formal drawings that conform to USPTO requirements and inserts a new claim 19. As for the claims 1 - 11, applicant respectfully submits that the rejections are improper for the reasons below:

I. The Lee reference (US 5,620,927) and the Inoue reference (US 6,460,755) do not anticipate claim 1 because the references do not disclose all the claim limitations.

Claim 1 describes a system for depositing solder onto a substrate. The claim has the following elements:

a. a horizontal member adapted to hold said solder (a solder holder);
b. a receiving member having a rotatable portion adapted to receive the substrate (a substrate holder) opposite the horizontal member (the solder holder);
c. a contact member, positioned between the horizontal member (the solder holder) and the receiving member (the substrate holder), having protruding portions adapted to selectively contact the substrate on the receiving member (substrate holder); and
d. the rotatable receiving member (the substrate holder) and the contact member together hold the received substrate in a substantially planar position with

respect to the horizontal member (solder holder) before and after the solder is deposited on the substrate.

In contrast, neither the Lee reference nor the Inoue reference discloses all the above elements of limitation in claim 1:

1. The Lee reference discloses a method and apparatus of attaching solder balls for semiconductor packages.[1] It does not disclose elements (b), (c), and (d) of claim 1:

   i. Element (b) is a receiving member having a rotatable portion adapted to receive the substrate (a substrate holder) opposite the horizontal member (the solder holder). The Office action asserts that members (12, 27) anticipate the element (b) as described in the specification (col. 3, l. 60 – col. 4, l. 2 and col. 5, l. 58 – col. 6, l. 19.) This assertion is not supported.

   Element 12 is the main station or housing of the ball-attachment machine and element 27 is an automated two-dimensional tilt table. According to the specification:

   > The attachment machine includes a main station or housing 12 having a reservoir 14 integrated therein. A receptacle 16 in the housing 12 is formed to receive a stencil holder 18 where a pair of finger indents 17 are formed in the sides of the receptacle to aid in the removal of the holder from housing 12.[2]
   >
   > The solder ball attachment machine may be optionally attached to an automated two-dimensional tilt table 27 that provides a horizontal motion to automate the procedure of filling the stencil holes.[3]

   There is no evidence from these descriptions and from FIG. 2 to support the assertion that either element 12 or element 27 anticipates a substrate holder opposite a solder holder. Neither can one find support in the paragraphs cited in the Office action:

   > The solder ball attachment machine may be optionally attached to an automated two-dimensional tilt table 27 that provides a horizontal motion to automate the procedure of filling the stencil holes. The machine may also incorporate various levels of automation, such as,

[1] See, US 5,620,927, Abstract.
[2] Ibid, col. 3, ll. 38 – 42.
[3] Ibid, col. 3, ll. 60 – 62.

vacuum assist, movement of substrate into or out of the machine, fluxing of substrate, for example. Further, an optional camera recognition system (not shown) for the detection of any missing solder balls in the arrays can be incorporated for more efficient operation.[4]

To operate the solder ball attachment machine, a stencil holder and a stencil (such as stencil 20 of FIG. 5) are placed in the receptacle 16 with the stencil being fitted into the stencil holder 18. The stencil may be inserted into the stencil holder either before or after the stencil holder has been placed into the housing 12 (as best seen in FIG. 2).

The reservoir 14 is filled with a supply of preformed solder balls 38 and the lids 24 and 26 are closed. The housing 12 may then be tilted to cause the solder balls to roll out of the reservoir 14 through its tapered mount and into the receptacle 16. Once a number of balls are in the receptacle, the housing may be tilted back and forth in a sluicing manner to cause the solder balls to fill the various array holes 21 in stencil 20. It should be appreciated that the optional vacuum assist would generally improve the rate at which the various holes are filled. Once all of the array holes have been filed, any solder balls that remain loose in the receptacle area are rolled back into the reservoir by tilting the housing in an appropriate manner. Visual inspection by an operator or a computer controlled camera system is then provided to make sure that the arrays are completely filled with balls. If not, corrective action can be taken at this point to fill the remaining holes by initiating the rolling process again. It should be appreciated that the described tilting actions may be done manually in a low cost system or using an appropriate tilting mechanism such as a tilt table 27. By way of example, the tilt table may pivot along a horizontal axis or it can move back and forth to provide a rocking motion. As will be appreciated by those skilled in the art, any suitable motion can be used that helps place the balls in the holes.[5]

ii. Element (c) requires a contact member, positioned between the horizontal member (the solder holder) and the receiving member (the substrate holder), having protruding portions adapted to selectively contact the substrate on the receiving member (substrate holder). The Office action asserts that member (18) anticipates element (c) and that projections including lip, shelf, and latches selectively contact the substrate as described in the reference (col. 4, ll. 3-14.). This assertion is also not supported.

[4] Ibid, col. 3, l. 60 – col. 4, l. 2.
[5] Ibid, col. 5, l. 58 – col. 6, l. 19.

As depicted in FIG. 4, element (18) does not have any hatches, and according to the specification, the lip or shelf is a part of the receptacle for receiving the stencil holder 18:

> FIG. 4 illustrates an perspective view of the stencil holder 18. The stencil holder unit fits into the stencil receptacle 16 of FIG. 2. Guide pins 32 are provided in the corners of the stencil holder. The stencil and substrate have preformed holes in corresponding corners that slip over the guide pins to compel proper alignment of the stencil relative to the substrate within the attachment machine. A lip or shelf formed around the edges of receptacle 16 such that the holder 18 is supported when inserted. When inserted into the receptacle 16, holder 18 is latched into place with an suitably latching mechanism (not shown). By way of example, the latching scheme may include a series of protrusions and matching holes formed on the holder and receptacle. The holder 18 can be conveniently unlatched at the appropriate time when the stencil is being changed. The holder 18 is designed to lock to the base while the strip is being removed after flipping over the machine.[6]

The stencil holder (18) has guide pins (32) that contact the substrate; but the stencil holder is not positioned between the solder holder and the substrate holder as required in element (c) of claim 1.

iii. Element (d) requires the substrate holder and the contact member together hold the received substrate in a substantially planar position with respect to the solder holder before and after the solder is deposited on the substrate. The Office action did not come forward with any evidence as to how this limitation is anticipated.

Because the Office action fails to support the assertion that Lee reference anticipates claim 1, claim 1 stands patentable over the Lee reference.

2. The Inoue reference discloses a solder bump forming method and an apparatus for forming the solder bumps. It does not disclose elements (b), (c), and (d) of clam 1:

i. Element (b) is a receiving member having a rotatable portion adapted to receive the substrate (a substrate holder) opposite the horizontal member

[6] Ibid, col. 4, ll. 15 – 32.

(the solder holder). The Office action asserts that the table member (41) anticipate the element (b) as described in the specification (col. 8, ll. 6 – 8.) This assertion is not supported:

> An air cylinder 39 is fixedly mounted at a central portion of the disk 38. When this air cylinder 39 is operated, a table 41 is moved upward and downward.[7]

There is no evidence that the table 41 is adapted to receive the substrate and there is no evidence that the table is on the opposite side of the solder holder from the substrate.

ii. Element (c) requires a contact member, positioned between the horizontal member (the solder holder) and the receiving member (the substrate holder), having protruding portions adapted to selectively contact the substrate on the receiving member (substrate holder). The Office action asserts that the plate member (51) comprises an aligner plate with projections for selectively contacting the substrate anticipates the contact member of element (c) as described in the reference (col. 8, ll. 9 – 19, col. 9, l. 47 – col. 10, l. 3, and col. 10, ll. 51 – 67.) This assertion is also not supported by any of the cited passages:

> The arraying jigs 50 are fixedly secured to the table 41 through respective plates 51, and are circumferentially spaced at predetermined intervals (of 120 degrees in this embodiment). The arraying jig 50 is constructed as shown in FIG. 9. The arraying jig 50 is formed into a box-like shape, and holes 52 for respectively suction holding the solder balls 61 are formed in a predetermined pattern in a lower surface thereof. A pipe 53 connects the arraying jig 50 to the air supply-discharge passage 33 formed in the shaft 27, and a vacuum pressure is supplied to the arraying jig 50 through the pipe 53.[8]
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> The positioning device 202 is constructed as shown in FIGS. 7, 10 and 11. Rollers 71 are rotatably supported on the base 1. An output shaft of a motor 72, supported on the base 1, is connected to the roller 71. A belt 73 is extended around the rollers 71. A carriage 74, carrying the packages 75, is placed on the belt 73. Through holes are formed

[7] US 6,460,755, col. 8, ll. 6 – 8.
[8] Ibid, col. 8, ll. 9 – 19.

through the carriage 74, and the packages 75 are mounted respectively in these through holes.

A y-axis linear stage 86 is supported on the base 1, and an x-axis linear stage 87 is movably supported on this y-axis linear stage 86. A .theta. rotating stage 88 is rotatably supported on the x-axis linear stage 87. A lift nozzle 77, having a pipe 78 connected to a vacuum source, is mounted on the .theta. rotating stage through a cylinder 76. The y-axis linear stage 86, the x-axis linear stage 87 and the .theta. rotating stage 88 are moved in response to instructions from the controller 85.

When the carriage 74, having the packages 75 placed thereon, is placed on the belt 73, the motor 72 is operated to convey the carriage 74. Then, when the carriage 74 is stopped at a predetermined position by positioning means (not shown) such as a stopper, the cylinder 76 is operated. The lift nozzle 77 moves upward, and holds the package by suction (vacuum), and further transfers the package 75 from the carriage 74 to the ball mounting position.[9]

As described above, the suction holding of the solder balls 61 at the indexing position A, the supply of the flux 70 to the solder balls 61 at the indexing position B, and the mounting of the solder balls 61 onto the package 75 at the indexing position C are effected simultaneously. Then, the cylinder 39 is operated to move the table 41 upward, and the servo motor 29 is operated to rotate the table 41 to index the same, and as shown in FIG. 12, the table 41 is once stopped when the arraying jigs are brought into opposed relation to the CCD cameras, respectively. The CCD camera 80 picks up an image of the lower surface of the arraying jig 50 which has vacuum picked up the solder balls 61, and the CCD camera 81 picks up an image of the lower surface of the arraying jig 50 carrying the solder balls 61 to which the flux has been supplied, and the CCD camera 82 picks up an image of the lower surface of the arraying jig 50 from which the solder balls 61 have been transferred to the package 75.[10]

Nothing in any of the paragraphs supports the notion that any part of the plate (51) contacts the substrate in any way and the figures (7, 10, and 11) do not depict the plate (51) as positioned between the solder holder and the substrate holder.

iii. Element (d) requires the substrate holder and the contact member together hold the received substrate in a substantially planar position with respect to

[9] Ibid, col. 9, l. 47 – col. 10, l. 3.
[10] Ibid, col. 10, ll. 51 – 67.

the solder holder before and after the solder is deposited on the substrate. The Office action did not come forward with any evidence as to how this limitation is anticipated. In fact, all figures that depict the package (75) show the package to be warped instead of being substantially planar with respect to the solder holder before and after the solder is deposited on the package.

Because the Office action fails to support the assertion that Inoue reference anticipates claim 1, claim 1 stands patentable over the Inoue reference.

II. Claims 2 – 11 depend directly or indirectly on patentable claim 1. Since the Office action did not discuss the patentability of each dependent claim individually, applicant respectfully submits that the dependent claims stand patentable at least by virtue of their dependency.

In summary, applicants respectfully submit that the formal drawings attached to this paper conform to USPTO requirement and the newly inserted claim 19 distinguishes over the prior art and is fully supported in the original specification and the original drawings. Because the Lee reference and the Inoue reference lack all the limitations of the claims 1 - 11, 102(b) rejections cannot be supported. Applicant respectfully requests that the rejections be withdrawn and the pending claims pass to allowance.

Respectfully submitted,

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